includes an element of subjective reaction to the sensation ; it is a phenomenon of will in its simplest stage. This decrease of will power, or reacting power, would render the fluctuations of attention greater. The remoteness in time seems to depend on the weakness of attention. As already stated, the actual time does not seem longer ; events are as correctly localized in time as in space. But whenever a memory of a past event, even though it occurred only a minute ago, is called up, it seems to belong to the distant past. Memories are remoter the fainter they are. The calling up of a memory requires an act of voluntary or involuntary attention. Any weakness of will would tend to produce a weaker—and thus remoter—memory. Since we know that memories grow fainter as the time elapsed is longer, an over-estimation of the past is natural.

The remoteness of objects in space is due to a conscious or unconscious estimate of the effort necessary to reach them. When the effort is more difficult, as with fatigue, hemp, etc., its amount will be over-estimated ; objects will appear remoter than otherwise although our previous knowledge of their space-relations prevents any distortion of space itself.

The drug finally produced faint illusions, chiefly ceilings decorated with colored designs, and finally sleep. It is noteworthy that the progress of the drug took place in stages, there being a continual fluctuation between loss and recovery of power.

The conclusion seems to be that among the earlier phenomena produced by *Cannabis Indica* the most prominent is a diminution of the power of subjective reaction in sensations, or a decrease of primitive volition. This leads to an incapacity for both involuntary and voluntary attention whereby sensations are dropped out of consciousness for intervals of time. The loss of power of attention also affects the memories, making them much weaker ; this leads to an over-estimation of the remoteness of past events although time is not directly overestimated. The decrease of volitional power leads to an over estimation of the remoteness of objects from the person, since to reach them would require more effort than usual.

Finally, let me suggest some lines of experiment to be performed before and during the influence of hemp : 1st. the rate of voluntary tapping to test the effect on simple voluntary movements; 2nd. graphic records of the time of fluctuation of some sound, to determine the periods of fluctuation of attention ; 3rd. estimation and record of one second of time ; 4th. experiments on will-time. Owing to disagreeable after-effects of the drug on my organism I shall probably be precluded, for some time, from carrying out these experiments myself.

LETTERS TO THE EDITOR.

**Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

SCIENCE IN THE SCHOOLS.—A REPLY.

Science of Sept. 29 contains an article by Professor Chapin discrediting the value of scientific instruction below the High School, and questioning the wisdom of placing such instruction in the grammar and primary grades. Several evident misconceptions in the mind of the writer both as to the nature and value of such science work impel me to reply. The wisdom of introducing and maintaining in the grades systematic training in the sciences, is believed to be made apparent by the following nearly axiomatic statements.

1st. The prime function of the school is to *educate* the individual in order that he may be of the greatest service to society in general and himself in particular.

2. A person has acquired intellectual culture—is *educated*—only to the extent that he has learned to use *all* his mental faculties to the best possible advantage, and has incidentally obtained some knowledge. To quote from most worthy authority, these faculties should be "like a team, which is *quick, strong* and *in harness.*"

3rd, Real science teaching supplies a training absolutely necessary for complete mental development, vital, in many cases, to the highest success of the individual.

4th. The particular training cannot be said to have been obtained generally under the old regime, as is well known by those who have had to deal with the graduate of our grammar grade.

As a teacher of the natural sciences, who has been trying for some time to determine *where, what* and *how much* such instruction should be placed in the grades below the High School, allow me to present briefly the results to be accomplished and make some suggestions as to how a place may be made for it even in our already over-crowded courses. Thorough scientific training, such as may be given by skilled teachers, will yield the following results:

1. *The cultivation of the powers of observation ; the ability to obtain knowledge first hand through the agency of the senses.* This, of itself, brings no special mental vigor, for savages are known with sight and smell developed to such an extent as to rival that of the beasts about them, and yet who cannot appreciate number beyond the fingers of one hand. Combine such power, however, with a mind well trained in other directions and you may expect wonders in the trades and professions.

2. *The preparation of written records of these observations in clear, accurate, concise language, supplemented with equally clear* and *accurate drawings.* In this way the quality and value of the observations are to be tested, the facts fixed in the memory and there is supplied a rigid, most valuable and so sadly needed exercise in the vernacular.

3. *Logical reasoning upon these observations, the deduction of truth* and *generalization.* Logical habits of thought and the ability to generalize, of course, characterize the mind of the scholar, but by judicious training they may be developed, and even earlier in life than is generally supposed by education. If oue observes closely a bright active child of three or four years of age, he will be found to be continually forming judgments and generalizing. His conclusions are generally wrong because based upon a too limited number of observations. I have seen an *eleven weeks'* old iufant make a series of observations, form three identical judgments and then arrive at a general conclusion. There has been so little in our elementary school courses to develop or in any way to call into action the reasoning faculties, that this characteristic is soon lost sight of. Arithmetic, when properly taught, gives a valuable training in deductive reasoning. but the tendency of even our best texts has been to disregard the discipline and render the processes largely mechanical.

4. *The acquisition of useful knowledge.* The amount of useful information to be obtained from a series of properly graded science lessons, extending over a period of eight or ten years, is by no means inconsiderable. A good elementary knowledge may be obtained of botany, zoölogy, geology, physiology, physics and chemistry; enough for general culture and to enable the pupil to read with some intelligence along any or all of these lines in case he must now leave school. A child of my acquaintance, before he had reached the legal school age, could point out the parts of a flower, locate the principal organs and bones of his body and could identify a dozen and a half of animals by their physical properties.

5. *A love of Nature.* Associated with a teacher enthusiastic in the study of Nature and natural phenomena, thoroughly imbued with a love of truth for its own sake, the pupil can scarcely fail to catch something of the teacher's spirit. A true appreciation, however, of the works of the Creator can come only when he, by means of scalpel and microscope, if need be, is given an insight into their *real* beauty, structure, harmony and wonderful diversity. In this most important respect they differ from the works of man,—the best of which must be viewed from this or that standpoint, in certain lights only or from a distance squinted at through a tin funnel. Nature may thus be given a new charm for the pupil, his walks to and from school, or into the country yield an added pleasure, his happiness has been multiplied by a factor, the value of which depends upon his teacher and himself, but which is always greater than unity. He now really

> "Finds tongues in trees, books in running brooks,
> Sermons in stones, and good in everything."

His mind engrossed in the contemplation of a plant, animal or pebble, or absorbed in the interpretation of some natural phenomenon, has little time for evil thoughts. He must grow wiser, better and more loving. I cannot agree with Professor Chapin that the collection of animals and plants and, if necessary, the "picking them to pieces" lessens in any way, the pupils' "regard for God's creatures." On the other hand, in this way is such regard most certainly developed and maintained, a bird in the hand being worth a *dozen* in the bush. This does not imply that the pupil is to *continue* his killing and picking to pieces, and my experience with boys is that those who have acquired the most intimate insight into the wonders of Nature hesitate longest before *wantonly* destroying any of her forms.

Instruction in the so-called "Natural Sciences" is peculiarly adapted to the lower grades. 1. The materials are, on every hand, directly associated with the pupils at all times, and constantly appealing to their intelligence. 2. These sciences are, for the most part, "observational," and their study admirably adapts itself to the natural development of the child's mental faculties. 3. The child takes a more active interest in everything that has been produced by Nature—that has "growed"—and especially is this true if the object is *"alive."* Were it not for this the *scientific* study of jack-knives or hairpins would serve a good purpose. 4. The collection of material takes the pupil into the open air. 5. The supplies cost nothing beyond a few lungs-full of this luxury, a brisk walk, an increased circulation and a healthy cheek-glow. 6. The information obtained contributes to the general culture of the pupil, is, at times, vital to his happiness and physical well-being, and has the advantage, *to him*, of having, in certain cases, a money-value aspect. In view of all that has been said, I would place this instruction not only in the primary grades, but into the kindergarten as well—I would go a step further and have the child make a feeble beginning while he is still tottering about his mother's knees. He is then, in reality, more of a scientist than he is given credit for. With the true inductive spirit of an original investigator he is discovering, with his spoon and ball, the laws of energy and the properties of matter—a veritable "Newton in petticoats."

Wide-awake teachers and superintendents experience no insurmountable obstacle to introducing some instruction of this nature into the already crowded curriculum. The time devoted to other subjects may be shortened by a few minutes each and fifteen to thirty minutes secured daily. It is confidently believed that the time lost in each subject will be more than made up to it through the discipline secured and the refreshed minds and spirits.

If it is not deemed wise to have daily lessons weekly exercises of thirty minutes each may be given Friday afternoons, some of the lighter subjects, as spelling, reading or penmanship giving way. This exercise may take the place each week of some one of the regular studies, changing from one to another, so that the loss to any one is imperceptible. Were I in a school where none of these methods could be put into practice, I would make the work optional and give it after school hours.

It is, perhaps, needless to remark that the entire course from kindergarten to high school should be unified and systematized. The observational sciences should come first and the experimental later. A portion only of each year should be devoted to any one science; zoölogy, botany and geology in the spring and fall, and physiology, chemistry and physics in the winter.

Whether or not our educational systems have made the failure ascribed to them by President Elliot, it is certain that much is to be placed to the debit side of the account, and it is gratifying to teachers of science to learn that the discipline he prescribes as a remedy, as well as much in addition, is fully covered by genuine science work. Pupils come from our schools with the verbal memory well trained and, if the school is of the best, some literary culture, but the majority are perfect imbeciles, as far as the use of their perceptive and reasoning faculties is concerned. In this particular they have gained but little, if any, over their childhood, while with an acquired amount of superstition, they fall a prey to imposters, quacks and sharps. A single one of the Detroit dailies carries from five to eight paid advertisements of clairvoyants who are presumably making a living upon the gullible people of that enlightened community. Some three weeks ago one of them, advertising to cure a long list of diseases, including all of a "strange and mysterious nature," was called upon to treat a boy supposed to be *bewitched.* Think of it! In this enlightened age, in a state which boasts of its educational system and almost within shouting distance of its great university. Upon the stand she admitted having no knowledge of medicine, and it required the coroner's jury to determine that she is a "fraud."

Give science a place in the grades along with the so-called "practical studies" and then shall we soon have a "survival of the fittest."

W. H. Sherzer.
Michigan State Normal School, Ypsilanti, Oct. 17, 1893.

BOOK-REVIEWS.

Text-book of Geology. By Sir Archibald Giekie. Third edition, revised and enlarged. London and New York. Macmillan & Co. 1893. pp. xvi, 1147, figs. 471, frontispiece.

The promised revision of this well-known work has just appeared in this country. The first edition came out in 1882 and the second in 1885. As stated in the preface, the book has been increased by about 150 pages. The value of the work has been further increased by the insertion of copious references to important memoirs and papers.

The arrangement of the matter treated is that followed in previous editions, the natural relations of the several subjects of which might well have been brought out by an introductory discussion of the philosophical classification of geological phenomena proposed by Gilbert. The sections on the characters of rocks have been largely revised and new and improved illustrations introduced. The reproduced photographs of porphyritic and orbicular structure on pp. 99 and 101 constitute a departure in text-book illustration which ought to be adhered to in